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Washington, DC 20005

EXAMINER

ASFAW, MESFIN T

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2851

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/589,437	Applicant(s) SHIRAISHI, KENICHI	
	Examiner Mesfin T. Asfaw	Art Unit 2851	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 July 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 July 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11/15/2006, 08/01/2007, 11/10/2008</u> . | 6) <input type="checkbox"/> Other: _____. |

DETAILED ACTION

1. Acknowledgement is made to a preliminary amendment to Claims filed on 07/26/2006.

Claim Objections

2. Claims 9 and 13 are objected to because of the following informalities:
 - (a) Claim 9 line 5 and Claim 13 line 5: the word "light" should be changed to "liquid". For the purpose of examination Examiner considered the word light to be liquid. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
4. Claims 1-3, 5-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukami [WO 9949504 A1, cited by the applicant] in view of Hagiwara [US 6437851 B, cited by the applicant].

As per Claims 1-3, 5, Fukami teaches an exposure apparatus (See fig. 1) that exposes a substrate W by irradiating the substrate with exposure light through a projection optical system PL and a liquid 7, comprising:

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a liquid supply mechanism (See fig. 2) that supplies the liquid between an image plane side tip part 4 of the projection optical system PL and an object W that opposes the tip part;

Fukami further teaches a control system 14 for regulating the supply volume as well as recovery volume of liquid 7 in a space, which is between the image plane side tip part 4 of the projection optical system PL and the object W and includes at least an optical path D of the exposure light.

Fukami does not specifically teach a timer that measures the time that has elapsed since the supply of the liquid by the liquid supply mechanism was started; and a control apparatus that determines based on a measurement result of the timer.

Hagiwara teaches a control system 25, and a solenoid valve 22 monitoring the flow so that at least a certain quantity of water flows into the drain pan 4 (Column 10 lines 59-67) and a timer to intermittently supply pure water from the supply piping 21. For example, pure water may be supplied in the order of one liter at a time per hour (Column 11 lines 13-32).

Thus, it would have been obvious, to one of ordinary skill in the art, at time the invention was made, to arrive at a timer that measures the time that has elapsed since the supply of the liquid by the liquid supply mechanism was started and a control apparatus that determines, based on a measurement result of the timer so that when a space, which is between the image plane side tip part of the projection optical system and the object and includes at least an optical path of the exposure light, is filled with

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the liquid the exposure wavelength is essentially shorten and the depth of focus widen which produce a better image transfer.

As per Claims 6-8, Fukami teaches an exposure apparatus (See fig. 1) that exposes a substrate W by irradiating the substrate with exposure light through a projection optical system PL and a liquid 7, comprising:

a liquid supply mechanism (See fig. 2 (5, 21, 22)) that supplies the liquid between an image plane side tip part 4 of the projection optical system PL and an object W that opposes the tip part;

a liquid recovery mechanism (See fig. 2 (6, 23, 24)) that recovers the liquid while the liquid is being supplied by the liquid supply mechanism, as well as after such supply has stopped (Page 7 Para 2). and

a control apparatus 14 that determines, whether the liquid has been recovered from the space between the image plane side tip part of the projection optical system and the object (Page 7 Para 5 – Page 8 Para 1).

Fukami does not specifically teach a timer that measures the time that has elapsed since the supply of the liquid by the liquid supply mechanism was stopped; and a control apparatus that determines based on a measurement result of the timer.

Hagiwara teaches a control system 25, and a solenoid valve 22 monitoring the flow so that at least a certain quantity of water flows into the drain pan 4 (Column 10 lines 59-67) and a timer to intermittently supply pure water from the supply piping 21. For example, pure water may be supplied in the order of one liter at a time per hour (Column 11 lines 13-32).

Thus, it would have been obvious, to one of ordinary skill in the art, at time the invention was made, to arrive at a timer that measures the time that has elapsed since the supply of the liquid by the liquid supply mechanism was stopped and a control apparatus that determines, based on a measurement result of the timer so that when a space, which is between the image plane side tip part of the projection optical system and the object and includes at least an optical path of the exposure light, is filled with the liquid the exposure wavelength is essentially shorten and the depth of focus widen which produce a better image transfer.

As per Claims 9-12, Fukami teaches an exposure apparatus (See fig. 1) that exposes a substrate W by irradiating the substrate with exposure light through a projection optical system PL and a liquid 7, comprising:

- a liquid supply mechanism (See fig. 2 (5, 21, 22)) that supplies the liquid between an image plane side tip part 4 of the projection optical system PL and an object W that opposes the tip part;

- a liquid recovery mechanism (See fig. 2 (6, 23, 24)) that recovers the liquid;

- a control apparatus 14 that determines whether a space, which is between the image plane side tip part of the projection optical system and an object opposing the tip part and includes at least an optical path of the exposure light, is filled with the liquid (Page 7 Para 5 – Page 8 Para 1).

Fukami does not specifically teach a first measuring instrument that measures the amount of liquid supplied by the liquid supply mechanism; a second measuring

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instrument that measures the amount of liquid recovered by the liquid recovery mechanism; and

a control apparatus that determines, based on the measurement results of the first measuring instrument and the second measuring instrument, whether a space, which is between the image plane side tip part of the projection optical system and an object opposing the tip part and includes at least an optical path of the exposure light, is filled with the liquid.

Hagiwara teaches a control system 25 (where the control system 25 can be set to measure the amount of liquid supplied and recovered as indicated in Column 11 lines 13-32), and a solenoid valve 22 monitoring the flow so that at least a certain quantity of water flows into the drain pan 4 (Column 10 lines 59-67) and a timer to intermittently supply pure water from the supply piping 21. For example, pure water may be supplied in the order of one liter at a time per hour (Column 11 lines 13-32) (if the specific time set is elapsed in the supply or drain activity then the control system 25 registers that the quantity of liquid would be in the condition of abnormality and it stops the activity of supplying or draining by controlling valve 22).

Thus, it would have been obvious, to one of ordinary skill in the art, at time the invention was made, to arrive at a first measuring instrument that measures the amount of liquid supplied by the liquid supply mechanism; a second measuring instrument that measures the amount of liquid recovered by the liquid recovery mechanism; and

a control apparatus that determines, based on the measurement results of the first measuring instrument and the second measuring instrument, whether a space,

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which is between the image plane side tip part of the projection optical system and an object opposing the tip part and includes at least an optical path of the exposure light, is filled with the liquid so that when a space, which is between the image plane side tip part of the projection optical system and the object and includes at least an optical path of the exposure light, is filled with the liquid the exposure wavelength is essentially shorten and the depth of focus widen which produce a better image transfer.

As per Claim 13, Fukami teaches an exposure apparatus (See fig. 1) that exposes a substrate W by irradiating the substrate with exposure light through a projection optical system PL and a liquid 7, comprising:

a liquid supply mechanism (See fig. 2 (5, 21, 22)) that supplies the liquid to a space between an image plane side tip part 4 of the projection optical system and an object W that opposes the tip part;

a liquid recovery mechanism (See fig. 2 (6, 23, 24)) that recovers the liquid;

Fukami does not specifically teach a measuring instrument that measures the amount of liquid recovered by the liquid recovery mechanism since the supply of the liquid by the liquid supply mechanism was stopped; and a control apparatus that determines, based on the measurement result of the measuring instrument, whether the liquid has been recovered from the space.

Hagiwara teaches a control system 25 (where the control system 25 can be set to measure the amount of liquid supplied and recovered as indicated in Column 11 lines 13-32), and a solenoid valve 22 monitoring the flow so that at least a certain quantity of water flows into the drain pan 4 (Column 10 lines 59-67) and a timer to intermittently

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supply pure water from the supply piping 21. For example, pure water may be supplied in the order of one liter at a time per hour (Column 11 lines 13-32) (where the timer can be set to count the time of supply or recovery as required by a specific design).

Thus, it would have been obvious, to one of ordinary skill in the art, at time the invention was made, to arrive at a measuring instrument that measures the amount of liquid recovered by the liquid recovery mechanism since the supply of the liquid by the liquid supply mechanism was stopped; and a control apparatus that determines, based on the measurement result of the measuring instrument, whether the liquid has been recovered from the space so that when a space, which is between the image plane side tip part of the projection optical system and the object and includes at least an optical path of the exposure light, is filled with the liquid the exposure wavelength is essentially shorten and the depth of focus widen which produce a better image transfer.

As per Claim 14, Fukami teaches the liquid is recovered while moving a recovery port of the liquid recovery mechanism and the object relative to one another (Page 7 Para 2).

As per Claim 15, Fukami teaches the object includes the substrate W or a movable substrate stage (9, 10) that holds the substrate (Page 6 Para 3); and

the liquid 7 is filled between the projection optical system PL and the substrate W or a prescribed region on the substrate stage (See fig. 1).

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5. Claims 4 and 16-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukami in view of Hagiwara as applied to claim 1 above and in further view of Levinson US 20050037269 A1.

As per Claim 4, Fukami in view of Hagiwara teaches an exposure apparatus according to Claim 1.

Fukami in view of Hagiwara does not specifically teach a detector that detects a gas portion in the liquid; wherein,

after the control apparatus determines that the space is filled with the liquid, it detects a gas portion in the liquid that filled the space.

Levinson teaches the apparatus and methods described herein can provide for real-time detection of a key parameter for immersion lithography. Namely, the presence or absence of a foreign body (or multiple foreign bodies) can be monitored to determine if conditions are favorable for exposing a wafer. Foreign bodies can include, for example, a particle such as an item suspended in the immersion medium 24. Example particles include, but are not limited dust, a contaminant, a stray piece of photo resist, and so forth. Foreign bodies can also include a bubble, such as an air pocket or other gas pocket disposed in the immersion medium 24. A foreign body can also be a particle with a bubble adhered to the particle. Even very small foreign bodies can interfere with the immersion lithography process. Therefore, the detection apparatus described herein can be configured to detect foreign bodies in the immersion medium having a size of about 50 nm across to about several microns across (Para 13).

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Thus, it would have been obvious, to one of ordinary skill in the art, at time the invention was made, to arrive at a detector that detects a gas portion in the liquid; wherein, after the control apparatus determines that the space is filled with the liquid, it detects a gas portion in the liquid that filled the space in order to increase the quality of exposed pattern and avoid defects in the integrated circuit being fabricated on the wafer (Para 17).

As per Claims 16-23, Fukami in view of Hagiwara and in further view of Levinson discloses a supply, recover and exposure method as claimed because under the principles of inherency, if a prior art device, in its normal and usual operation, would necessarily perform the method claims, then the method claimed will be considered to be anticipated by the prior art device. When the prior art device is the same as a device described in the specification for carrying out the claimed method, it can be assumed the device will inherently perform the claimed process. In re King, 801 F.2d 1324,231 MPEP 2112.02”

As per Claim 24, the claim is directed to a device fabricated by a method of claim 1. However, it is conceivable that the device can be made by another method other than the method of claim 1. The patentability of a device/product does not depend on its method of production. The claim is unpatentable even though the prior art product was made by a different process/method.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mesfin T. Asfaw whose telephone number is 571-270-5247. The examiner can normally be reached on Monday to Friday, 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diane Lee can be reached on 571-272-2399. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mesfin T Asfaw/
Examiner, Art Unit 2851

/Diane I Lee/
Supervisory Patent Examiner, Art Unit 2851